

Effects of Fishing Activities on Benthic Habitat: Developing a Joint NOAA/USGS National Initiative

Field surveys show that certain fishing practices alter the seafloor and thus affect animals and plants living there. Such changes in benthic habitats may harm fisheries. To help conserve fisheries, the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Geological Survey (USGS) are partners in a national initiative to

- identify and map benthic habitat characteristics and the extent of fishing impacts
- determine the effects of fishing activities on benthic habitats
- assess the relationship between benthic habitats and sustainable fisheries
- recommend appropriate management strategies

Fishery harvest from the ocean floor can disrupt and alter the seabed in many of the same ways farming and logging disrupt the soil and its ecosystem. Like forests and farm soil, the seabed is an essential habitat for the health and productivity of many animals and plants. Its character, as well as the extent and impact of its alteration by fishing, is virtually unknown except in a few small study areas.

A joint NOAA/USGS initiative proposes to map the seabed and study relationships between fisheries and the geology of benthic habitats along the U.S. coast. It focuses on relating the effects of fishing to geological characteristics of benthic habitats. These characteristics include the detailed morphology of the seafloor, the stability of seafloor sediment, geochemistry, and sediment dynamics.

The two agencies bring unique strengths to their partnership: NOAA manages the Nation's fisheries and National Marine

Sanctuaries, and provides national expertise in biological assessments. NOAA also has submersibles and underwater robots and the capability to conduct coastal surveys. The USGS has particular strength in making and interpreting regional seafloor maps. These maps can reveal the shape and geologic makeup of the seafloor, as well as the geologic processes that occur there, such as sediment deposition and erosion.

Initially, NOAA and USGS will plan and undertake activities under two themes:

- Determine the effects of fishing gear on benthic habitat
- Identify and map benthic habitat characteristics and the extent of fishing impacts

Theme 1. Determine Effects of Fishing Gear on Benthic Habitat

The Magnuson-Stevens Fishery Conservation and Management Act, passed in 1976 and reauthorized in 1996, is the primary law dealing with fishing in Federal waters (those waters extending from the edge of State waters to the 200-mile limit). The act created eight Regional Fishery Management Councils to work with NOAA's National Marine Fisheries Service (NMFS) in implementing the act's goals, one of which requires the Federal Government to "minimize to the extent practicable



Pair of photographs illustrates differences between disturbed and undisturbed seabed. Left: Undisturbed gravel habitat with colonies of hydrozoans, bryozoans, and white calcareous tubeworms attached to gravel at a depth of 84 meters (275 feet).



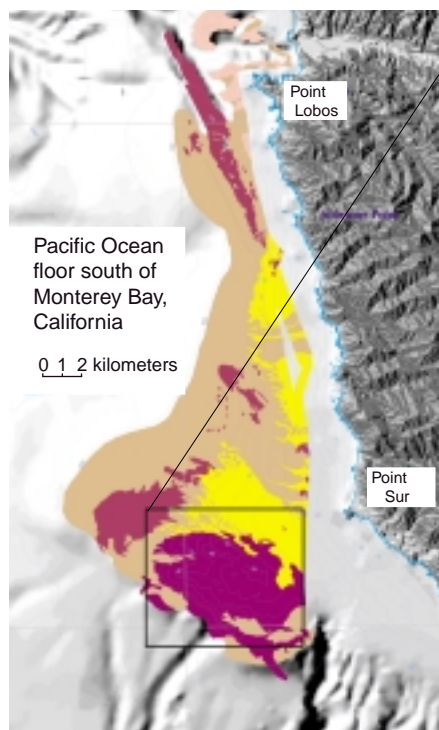
"Shrimp circle" associated with a cerianthid burrowing anemone on muddy sand at a depth of 105 meters (about 340 feet). Photograph taken in Stellwagen Bank National Marine Sanctuary, off Boston.

adverse effects on [essential fish] habitat caused by fishing...." Implementing this goal can lead NMFS and the Regional Fishery Management Councils to take controversial actions, such as restricting or banning certain types of fishing gear or activities. To minimize controversy in fisheries-management decisions, NOAA and USGS plan to take the following steps:

- Gather information on the extent of fishing-induced disturbance (see Theme 2)



Right: Disturbed gravel habitat in active scallop fishing ground, 500 meters (about 1,600 feet) from location of left-hand photograph. Both photographs are from Georges Bank fishing grounds off New England.

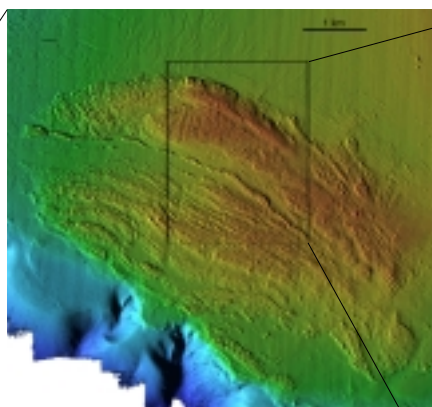


Seafloor types off central California, south of Monterey Bay. Pink tones near Point Lobos represent granite outcrops; red areas, sandstone and metamorphic rocks; yellow areas, coarse sand; tan areas, mud. Rectangle outlines area known to fishermen as Sur Pinnacles.

- Gather information about the effects of specific gear on specific habitat types
- Develop predictive models to link fishing-induced disturbance to the population dynamics of commercial and non-commercial species
- Make seafloor habitat maps of representative areas in the Nation's eight fishery management regions
- Develop techniques to alleviate the effects of fishing activities or restore habitat damaged by fishing gear

Theme 2. Identify and Map Benthic Habitat Characteristics and the Extent of Fishing Impacts

Knowledge of the seafloor—what it is made of, what animals live on and near it, how it changes in response to natural processes, how it changes in response to human influences—is critical to the conservation of fisheries that depend on the seafloor. A first step in gathering this knowledge is making maps. The outer portion of the U.S. Exclusive Economic Zone (deeper than 200 to 500 meters) has been imaged with side-scan sonar, but broad



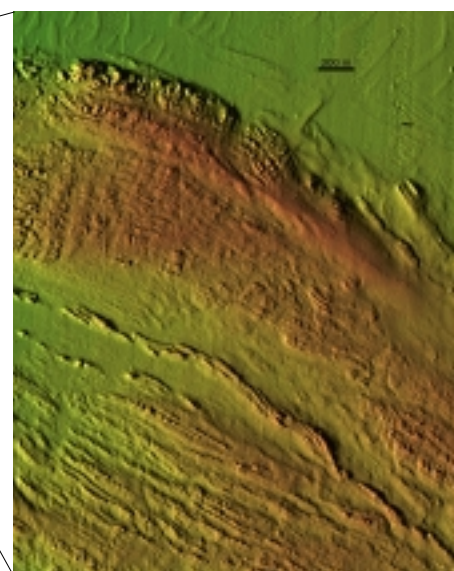
Hard rocky ridges that make up Sur Pinnacles are clearly visible in these shaded-relief images from a multibeam bathymetric map made in 1998. Fishermen have trawled around the edges of Sur Pinnacles for rockfish.

areas of the continental shelf and slope remain to be systematically imaged. Most maps currently available for the coastal ocean were made using technology developed in the 1950s or earlier. These maps have poorly navigated data points by today's standards. The data they provide are inadequate for addressing regional and national questions of benthic-habitat management, which require accurate geo-referenced measures at meter and centimeter resolution.

A suite of new acoustic, photographic, and laser mapping technologies are currently available for mapping along the U.S. coast and continental shelf. Working with partner agencies has enabled USGS to use state-of-the-art technology to map about 2,700 square kilometers, or about 0.2 percent, of the continental shelf in selected areas each year for the past 4 years. This mapping has contributed to successful habitat characterization projects off New England, Florida, southern and central California, southeast Alaska, and Hawaii. The long-term goal is a multi-year, geomorphic, biologic, and geologic mapping effort using the new technologies.

The Proposed Initiative

The NOAA and USGS Joint Initiative focuses on links between fishing gear, biological resources, and seafloor geology. The two agencies and their academic partners plan to study these links in the context of large-scale surveys conducted to map seafloor areas and characterize their biological and geological attributes. The projects in this initiative integrate across the disciplines of geology, benthic ecology,



The interior of Sur Pinnacles is too rough for trawling; fishermen use hand lines above this rocky seafloor. Some similar rocky areas along the California coast, such as the Big Creek Ecological Reserve, have been closed to fishing to serve as refuges.

and population dynamics of resource species. This integration—which will play a major role in fisheries science and management in NOAA in the future—has been made possible by recent and continuing advances in acoustic and optical technologies, remote mapping techniques, and computer processing of vast amounts of data.

A key aspect in this collaboration is the potential to scale up site-specific studies of habitat function for resource species to geographic scales that are appropriate to fisheries and their management.

Long- and Short-term Goals

The products anticipated in the long term from a fully funded effort are state-of-the-art base maps, data bases, and interpretive maps for all the United States coastal and continental shelf areas south of Bering Strait. During 2000, a detailed research plan for conducting geomorphic and biological mapping and research will be developed for each of the Nation's eight fishery management regions.

For more information

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